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enormous reservoirs might be formed, which would have the same effect as the forests in preventing the sudden rush of surface drainage, which was the great danger to be apprehended to the lower country where rice was cultivated.

2. *Description of the Island of Rapa.* By Captain VINE HALL.

I MAY commence my notes by saying that the island has been hitherto erroneously called Opara; but on my recent visit to it I enquired particularly as to its proper native name, which I found was pronounced nearly as if spelt with an L, and two ps, or Lappa. Opara, they said, "was English name." In future it will be called Rapa.

This Island—like other places one might mention—has acquired a temporary and adventitious value, principally from its position, and the possession of a harbour. It was first discovered by the English navigator Vancouver, since which time it has apparently been very little visited except by the small trading-vessels from the neighbouring islands. Vancouver described it truly, as rugged, formed of craggy mountains, with very little level ground—the narrow valleys between the precipitous hill-sides affording the only space for a limited cultivation.

The position of Rapa is in $27\frac{1}{2}$ ° s. latitude, and 144° w. longitude; about 700 miles s.e. of the Society group, and as nearly as possible two-thirds of the distance between Panama and Wellington.

Very little was generally known about the island till lately, and nothing of its being favoured with so perfect a harbour. The finding of it out was the result of very many enquiries I made from every one I could hear of who had been to the South Sea Islands, as to the existence of some suitable spot, where we might have a coal dépôt. For, on the establishment of the Panama service, I was so impressed with the desirability, if not necessity, of some stopping-place near the route, that I used every effort for months, endeavouring to find one. At last I was rewarded for my pains by hearing of Rapa.

Its situation, just on the outer verge of the Southern Archipelago and in the direct track (not the direct line) between Panama and New Zealand makes it particularly advantageous as a place of call in case of accident or deficiency of fuel.

And, speaking of the track of the steamers between New Zealand and Panama, I will for an instant advert to the difference of route in going towards Panama and returning from it.

Leaving Wellington, we adopt what is called the "great circle" course, which, though apparently roundabout, is in reality the

direct and shortest line to Panama. Now, in returning from Panama to Wellington, we appear to adopt a much straighter course, but it is really somewhat longer. This is readily explained by reminding you that we are not sailing upon a level, but a curved surface. Take a round body to represent the earth, a thread stretched between any two points, is evidently the shortest distance between them, and viewed in a line with the centre is straight. This should be the ship's course. But on the chart generally used, this straight line will appear a curve—and all the straight lines (meridians excepted) are really curves. And although Mercator's projection, as it is called, is the most simple for the ordinary purposes of navigation, yet it has led many people, and even seamen, to have confused ideas upon this very simple subject. In the track upwards to Panama the winds are frequently found favourable, because the course lies principally in the well-known belt of westerly winds. From Panama we keep further north, through the heart of the easterly or trade winds prevailing generally, though varying with the seasons, between the equator and the southern tropic. In this part of the voyage the winds are less favourable than the other, and particularly in the latter part, trying to avoid the westerly or adverse winds which prevail further south, we adopt this track which brings us close to Rapa.

The island is of very irregular form, with several indentations in the coast; two of which are considerable bays, having each its little village, whilst the third and largest is the harbour. It is about twenty miles round, though from the irregularity of its outline it is difficult to estimate this exactly. The coast is bold, with no out-lying reefs beyond half a mile.

The French have assumed the protectorate of it—on the ground, I believe, that it is a dependency of the Tahitian group; but looking a day or two ago at a recent French map of the world dedicated to the Emperor, I saw a circle described round the Society group, as the limits of their protectorate. Now this line happens to be more than 200 miles distant from Rapa; and had we not established a station there, I fancy they would never have gone near it. But the French having made an effort to induce the Company to adopt Tahiti as the half-way house, of course unsuccessfully, and hearing that we were in search of a place more in the track than Tahiti, they fancied it must be at one of the Gambier Islands, lying considerably to the N.E. of Rapa, and included in the protectorate circle. Accordingly they sent a Resident there to watch our proceedings. Finding after some time that we did not appear there, but had selected Rapa for our port of call, the same Resident was

sent to that island in the early part of the present year, on board the French war transport *La Dorade*. A few months previous to this, and subsequent to our appearance at the island, another French steamer, *La Touche Treville*, called at the island. They make out for the first time that Rapa—though nearly, as I said, 300 miles out of the magic circle drawn by themselves round the Society group—belongs to the Tahitian protectorate. Some three months ago the French war steamer *La Touche Treville* called at the Island, as I am informed, made nearly all the inhabitants drunk, and got the King Tapanua (a most powerful toper) and two chiefs, Miroto (the man who betrayed the Tahitians to the French) and Eiton, to sign away the island to the French. This Eiton told me himself. Many of the influential chiefs being absent, kept sober on the occasion, and deny the King's right to alienate any lands not his personal property. His dusky majesty having drunk all the rum, now begins to repent his bargain, and hopes the English will come to the island and preserve him from all intruders. The object of the French was, as one of their captains told us, simply to embarrass the operations of the Company, or they certainly would not incur an expense of about 600*l.* per annum to watch our coaling merely.

It is only due to the supineness of the English Government that this fine harbour is not under their control; for three years ago, on my representation, application was made to the Admiralty to send a man-of-war there. However, nothing was ever done in the matter.

The appearance of Rapa as we approached in the *Ruahine*, was very picturesque, with its sharp peaks thrust up as it were into the air, through the irregular but more rounded forms of the mountainous hills of the island. The harbour lay just before us, with two coal-ships securely moored about two miles off, there being seemingly no obstruction between us and them. But beneath the quiet-looking surface lay the treacherous reefs, which, difficult and dangerous as they are to approach heedlessly, form the security of the harbour. We stopped some time, close to the entrance, waiting for a boat to come off, the Captain prudently hesitating to enter, lest the buoys might by accident have become displaced. And the event proved how wise this precaution was, for we found afterwards that one of the principal buoys had been driven by a recent gale quite across the Channel. At length the expected boat came, with the Captain of the Company's coal-ship, and a native pilot. We moved cautiously ahead, and very soon the bottom was clearly visible under us; then we approached the entrance of the narrow tortuous channel among the reefs, the rocks glistening just below

the surface, ominously close to the ship at times. The Captain and our two pilots were all on the *qui rive*, as we threaded the crooked passage, appearing as a blue line amid the black and green patches of the reefs. It was with a feeling of relief we at length saw that we were safely through the lines of buoys, and found ourselves in the most romantic, snug harbour imaginable; the land rising on three sides, like the walls of an amphitheatre, and protected by the reefs and a beacon islet on the fourth, or eastern side; with the advantage of having fresh air from the open sea. Twenty ships might moor safely there, and small craft innumerable. The endless variety of form and colour around us was most enchanting. Near our anchorage was a very small village, rejoicing in thirty-one inhabitants; but further off, on the opposite side, was another large village, which we call the capital—where the King and the French Resident live. We only regretted to see the French flag waving there instead of the English; and there is not the slightest doubt but that the natives would themselves have preferred it. It is, perhaps, matter of legitimate regret that the simple manners and customs—the primitive feudal sway of the native chiefs—should be interfered with by either flag.

Our coaling, of course, was proceeded with at once, and the greater part of the passengers, anxious to escape for a while from their iron prison, gradually dispersed on shore; whilst those who remained made bargains with the natives for coral, tropical birds' feathers, bananas, &c. I began doing a little sketching, and, after securing some of the very peculiar features of the land, my next object was to determine, with a moderate degree of accuracy, the height of the most prominent of the remarkable *aiguilles* which jut up in this curious island. This had never been done, and, previous to arrival, I had received so many different guesses at the height of the Rapa peaks, varying from 400 to 1400 feet, &c., that I was the more anxious to arrive at something definite. The difficulty was to secure a sufficiently level space to measure a base-line (not the most easy thing to do with precision, even under favourable circumstances). However, finding the shore was impracticable, I selected a spot on the beach, nearly in a line with the ship and the mountain. Then I ascertained the length of this in three ways. One by measurement from the chart, another by sound, and thirdly, by the angle subtended by the ship's whole length with sextant. The average of these gave me a tolerable base, and of course by the angles at each end of the same, and a little triangulation, I arrived at the height of the peak I selected,—viz., 2100 feet. My short experience of the inhabitants, together with the testimony of others, gave me a very

favourable impression of their peaceful simplicity of character and honesty. They number now only about 125 to 130 men, women, and children. Formerly it was thought, and, indeed, according to their own account, there were 1200 to 1500 in number. But it is said that internal wars in the first instance, and then the ravages of various epidemics brought amongst them, have reduced the inhabitants to the present limited number. They are in appearance a fine, manly, well-made race, and looked very Maori to me. The wonder is that, living as they do principally upon an esculent root called "taro," somewhat tasteless and insipid to us, with a scanty supply of meat and fish, they keep up so good an appearance.

The language generally, the names of the points of land, mountains, &c., seemed to my ear also very Maori like. However, I cannot speak very positively on this head, as my Maori lore is not great. Almost the only word of Maori which I know (and that they tell me is wrong) is—*Tenako*. Of course I tried the effect of this, but I was responded to by—*Uronnah!* sounding very much like "Your-honour," which I thought properly respectfully and somewhat Irish.

The climate of the island must be to a European very delightful; for, surrounded as it is by the sea, the temperature is very equable, and though close to the Tropics the thermometer seldom shows more than 75° in the height of summer. The weather, though mostly fine, is changeable, with occasional sudden showers, as might be expected from the effect of the high peaks arresting the clouds and causing them to precipitate their suspended moisture. The winds are for nearly nine months of the year from south-east to north-east, and westerly the remaining part. For, of course, lying so near the Tropic the trade-wind is swayed southward by the sun in the summer time (November, December, January, and February), when the island is embraced by it, and left in the winter to the northern limit of the regular westerly current of air which then extends more northerly. I have arranged with the Meteorological Department in England to make it a station for those observations, and very shortly the instruments will be there; so that Rapa may become a point of great scientific interest and utility. In fact, the Southern Pacific being an almost unknown sea to us, meteorologically, the importance of this fixed station at Rapa, in conjunction with the observations on board the Panama ships, and in New Zealand, cannot be too highly estimated.

We have already a tide-gauge there, showing the extreme rise and fall to be 2 feet 6 inches, and the establishment of the port, or high water at full and change, 12·15. The wave which in August

swept along these coasts was also felt at Rapa, indeed it partly washed away our coal-wharf. There was also a slight earthquake, the impulse of which came from the south, coinciding very nearly in point of time with the disturbances felt here and those which have desolated Peru; all which effects confirm very significantly the sagacious predictions of our friend Dr. Hector, of the locality of the principal eruption. Further particulars and more exact information relative to the time of those occurrences will invest these phenomena with yet greater interest.

The peculiar irregular form of the land with precipitous mountains and deep gullies cause sudden gusts and eddies of wind in the harbour, varying continually in direction, so that it is difficult to say exactly what wind is blowing outside, unless it happen to be from the eastward or directly in. There is a remarkable absence of surf, I am informed, which is not easily accounted for; my correspondent saying "that landing is easy anywhere, and boats can lie alongside precipitous cliffs exposed to a swell which rolls in unchecked for thousands of miles without breaking." I am quoting from a letter to me from our representative.

The resources and products of the island are at present but few in number or quantity, excepting perhaps goats, which abound, and are to be seen everywhere delighting in the most inaccessible places, where, with a glass, their forms moving to and fro on some razor-edged mountain stand out in relief against the sky. Small vessels occasionally take a cargo of them away to Tahiti. I was told that the Governor of that island had ordered the French Resident at Rapa to have them all destroyed. Upon what enlightened principle, it is difficult to say; but the Resident had too much good sense to comply with the order. The *Ruahine* had the previous voyage landed on trial some sheep, but they did not seem to thrive. A few pigs are procurable—good, but dear. There are a few fowls wild in the bush, some widgeon, and of course sea-gulls. There are no reptiles, although one of our passengers told me he had been in bodily fear of them all day; and his enjoyment had thus been very unnecessarily marred. Rats are very numerous. It is curious that when our coal-ship first went there they were troubled with mosquitoes, though none were found on shore. They were in fact taken there in the ship, and have now disappeared. There is an abundance of fish; some very beautiful, especially the parrot and gold and silver fish; good mullet, and some other kinds are readily procurable; of sharks, plenty.

The taro-root, the chief support of the inhabitants, grows abundantly, but requires attention to its culture, as it will not grow

without plenty of water. We left a quantity of English vegetable-seeds, and we hope they will do well. Water-melons are plentiful and cheap; bananas grow well, and are very good; oranges are produced, but of very poor quality; pine-apples, also very inferior. The sugar-cane likewise grows well, and there were cocoa-nuts formerly on the island, but a blight destroyed them all some years ago. I could not ascertain if they thrived well; but, I believe, the cocoanut tree is a great discerner of latitude, and will not flourish out of the Tropics. Our representative told me he was very successful with his cabbages; tolerably so with maize, less so with his potatoes, doubtless owing, as he said, "to his ignorance of gardening."

Coal of a very inferior quality has been found in the interior; the natives use it occasionally for cooking, &c. But it is useless for steam purposes.

The land is generally covered with thick scrub and fern, showing here and there clear spaces of a kind of coarse grass, which grows 5 or 6 feet high. There are a few beautiful flowering shrubs, and, whilst the tree and smaller ferns abound, trees of tolerable size are found in the northern part of the island, but only small ones near the harbour. The cultivation is limited because the requirements are so small; still vegetation is most luxuriant, and the soil appeared to me of the richest kind. True, the level ground is comparatively of small extent, but there are many hundreds of acres which might readily be cultivated.

There are curious remains of apparently fortified places at Rapa, said to be the defences of the earlier warlike times. On the summits of many of the steep hills are to be seen these square fortresses, some of very elaborate construction. But what is very singular, they are mostly solid within. The stones are well squared, of very large size, and well cemented. Around or on the top of one in the interior are still the bones and skulls of a number of warriors to be found, who, they say, were starved out by their opponents. I regretted much that I hadn't time to make an exploration of those and other places myself. I may just mention that the remarkable group of rocks, called "The Four Crowns," and which on many charts are marked "doubtful," not only exist, but may be seen on a clear day from Rapa, some 40' off.

The French Resident, Mons. Caillet, gave me one piece of information, which is generally interesting, and to navigators valuable. It is that Easter Island, the natives of which have hitherto been found fierce and treacherous, rendering any attempt at communication dangerous, may now be visited without apprehension, and supplies obtained. This happy change has only recently been effected

by the influence of some courageous and benevolent French priests, who ventured upon the difficult task of endeavouring to civilise these hitherto savages.

But the coaling is done, the signal-gun is fired, and the *Ruahine*, by the fiercely blowing-off steam, seems impatient to be away again; so the stragglers get on board with their spoils of coral, and fern, &c.; we cast off from the hulk, and, with captain and pilots once more at their posts, we move slowly ahead towards the sinuous pathway amid the reefs, and which, at a distance, is only indicated by the buoys on either side of it, looking like small red spots on the north of the channel, whilst black ones mark the limit of safety on the south side. I took my post in the fore-top, that I might the better see the reefs mapped out, as they beautifully were below and around us. The light gleams again on the scarcely covered rocks here and there which we have to pass, and the general interest in this short but intricate bit of navigation is greater than ever. We at length pass between the last of the black and red buoys, and are once more in clear water. We bid adieu to our skilful pilots, their boat returns to the harbour; we again go "full-speed ahead," and then have a capital view of this interesting little island as we sail and steam round it. It was a beautiful sight watching the many *varied* and *varying* forms, and tints of colour too, of the needle-like peaks and crags, and deep valleys, with their exuberant vegetation, and here and there a dark precipitous cliff, having a sparkling stream of water, like a silver-thread running down its face. But we rapidly left behind this our last stopping-place, becoming very soon too distant for us to admire it any more; and Rapa at length melted away from our view, absorbed in the purple haze of sunset, leaving us to turn our thoughts, hopes, and expectations exclusively to New Zealand.

THE PRESIDENT returned thanks to the author of this communication, which gave a description of an island of which few geographers had heard before. There were several naval officers present who had been in the South Pacific: he should be glad to hear remarks from them respecting the importance of this island as a coaling station.

Captain C. W. HOPE, R.N., said he had served for about four years on the Australian station; but he had never visited the island of Rapa, though he had paid frequent visits to other parts of the South Seas. With regard to the island, there was just this connected with it,—that the Panama route to New Zealand and Australia might possibly not be of very long duration, because he saw by telegrams in that day's papers that the New South Wales Government had cancelled the contract. Therefore it was not at all improbable that, in a very short time, the Panama route would cease to exist; and on that account the island of Rapa would lose its importance. But there was one point worthy of attention, and that was the great importance of Rapa as a meteorological station in the South Pacific, similar to St. Helena and Ascension in the South Atlantic. In the Fiji and other groups of South Pacific islands—the Friendly Islands and

the Navigator Islands—we had intelligent residents and officials who were well-qualified to take meteorological observations. The island of Rapa occupied a central position in the South Pacific, and no doubt very important facts might be brought forward by having a meteorological station there. If the Panama route should cease to exist, it was more than probable that other lines of steamers would be running across the Pacific from San Francisco to New Zealand and the Australian colonies. In that case Rapa would be far out of the way, the great stopping places and coaling dépôts would be further north, either the Sandwich Islands, the Fiji, or the Navigator Islands.

Sir GEORGE GREY, at the invitation of the President, briefly addressed the meeting. He observed that he should be happy to say anything that would convey information to the Society, but he had never visited this island. The only remark he could make was that the prefix "O" in all the South Pacific languages signified that the word was used to name a "place." For instance "Tahiti" really meant "distance;" but the "O" being put before it signified that the word "distance" was here used as the name of a place. In the same way "para" was the name of a fern that grew abundantly in the island: "Opara" would signify that the word was used as the name of the island.

Sixth Meeting, 8th February, 1869.

SIR HENRY C. RAWLINSON, K.C.B., in the Chair.

PRESENTATIONS.—*F. G. H. Price, Esq.; Rev. W. W. Lane; R. J. Moser, Esq.; J. H. Paul, M.D.; Alfred Richards, Esq.*

ELECTIONS.—*K. T. Digby, Esq., M.P.; Prof. T. H. Huxley, F.R.S., &c.; Richard O'Shaughnessy, Esq.; Viscount Southwell; C. Holborn Stanton, Esq.; Sir William Yardley.*

ACCESSIONS TO THE LIBRARY FROM 25TH JANUARY TO 8TH FEBRUARY, 1869. 'Geography of New South Wales, 1863.' By W. Wilkins. Donor, J. Power, Esq. 'Geography of Wurtemburg, 1862.' By E. Schwartz. Donor, J. Power, Esq. 'L'Etbaye; Pays habité par les Arabes Bichariel.' Par M. Linant de Bellefonds. Atlas. Paris, 1869. Donor, the author. 'School Atlas of Astronomy.' 'School Atlas of Geography.' By A. Keith Johnston. Edinburgh, 1869. Donor, the author. 'Handbook for Posen, 1866.' 'Handbook for Marienburg.' Leipzig, 1858. Donor, S. M. Drach, Esq. 'Physical Survey of Virginia.' By M. F. Maury. Richmond, 1868. Donor, the author. 'The Statesman's Year-book for 1869.' Purchased. 'Page sur L'Orient.' Par P. de Tchihatchef. 1868. Donor, the President

ACCESSIONS TO MAP-ROOM, SINCE THE LAST MEETING, JANUARY 25TH, 1869.—Plan of the Caucasus, showing the Routes of Messrs. Freshfield, Moore, and Tucker, 1868. Presented by A. Petermann. Plan of the Fiji Islands, showing the Routes of Wilkes and Denham. Presented by A. Petermann.

The CHAIRMAN, in opening the business of the evening, said he was sorry to inform the Meeting that their excellent President, Sir Roderick Murchison, was unable to be present owing to the precarious state of Lady Murchison's health. In taking the chair, at the President's request, he felt that Sir Roderick's shoes were too large for him, and that any one who attempted to fill them would go with a shuffling sort of gait. However, he would do his best to supply his absence.

1. *Soundings and Temperatures in the Gulf Stream.* By Commander W. CHIMMO, R.N.

TOWARDS the latter part of the year 1868, after H.M.S. *Gannet* had been upwards of three years on the North American and West India Station, she was ordered during her homeward voyage to define the northern limits of the Gulf Stream, and to take deep soundings and temperatures within those limits.

Sailing from Halifax, in Nova Scotia, on the 1st of July, the ship passed from water whose surface temperature was 51° to that of 61° , in less than an hour, shortly afterwards to 64° ; showing that the Gulf Stream water had been reached since leaving that place.

Lat. $43^{\circ} 20' n.$; long. $60^{\circ} w.$ —To the south of Sable Island, 30 miles, a sounding was obtained of 2600 fathoms or 15,600 feet, nearly 3 miles; with a weight of 232 lbs., and the ingenious machine invented by Brooke, the rod brought up, after four hours' patient hauling, Foraminifera in their various forms, chiefly Globigerinæ. Forms and clusters of three, four, and five chambers; the interior of those fully developed was coated with an apparently fine crystallised, many-coloured, quartzose sand—of these forms some were circular—flat and plate-shaped, having a smooth interior rim (the Polycystina); the outer margin serrated, and the centre coated with the same granular particles. Others hemispherical, some single, globular; others, fragments as thin and transparent as water; intermixed with these were particles of transparent many-coloured crystals, with coccospores in all stages of growth and size.

The towing-net collected seven species of Crustacea, one *Cornucopia*, and a *Janthina fragilis*; the dye from which latter, when placed in a wineglass of clear water, coloured the whole a rich mauve. A very small portion of this apparently impalpable adhesive mud, diluted, and placed under the microscope, showed a field of the most perfectly-formed organisms.

The ship next sailed to the western edge of the Grand Banks of Newfoundland, where a sounding of 1500 fathoms brought up what appeared, under a common glass, minute particles of transparent quartzose sand, with globular forms of calcareous formation; also some algæ with parasitical attachments, probably of lime, but all formed by animal life out of carbonate of lime from ocean waters.